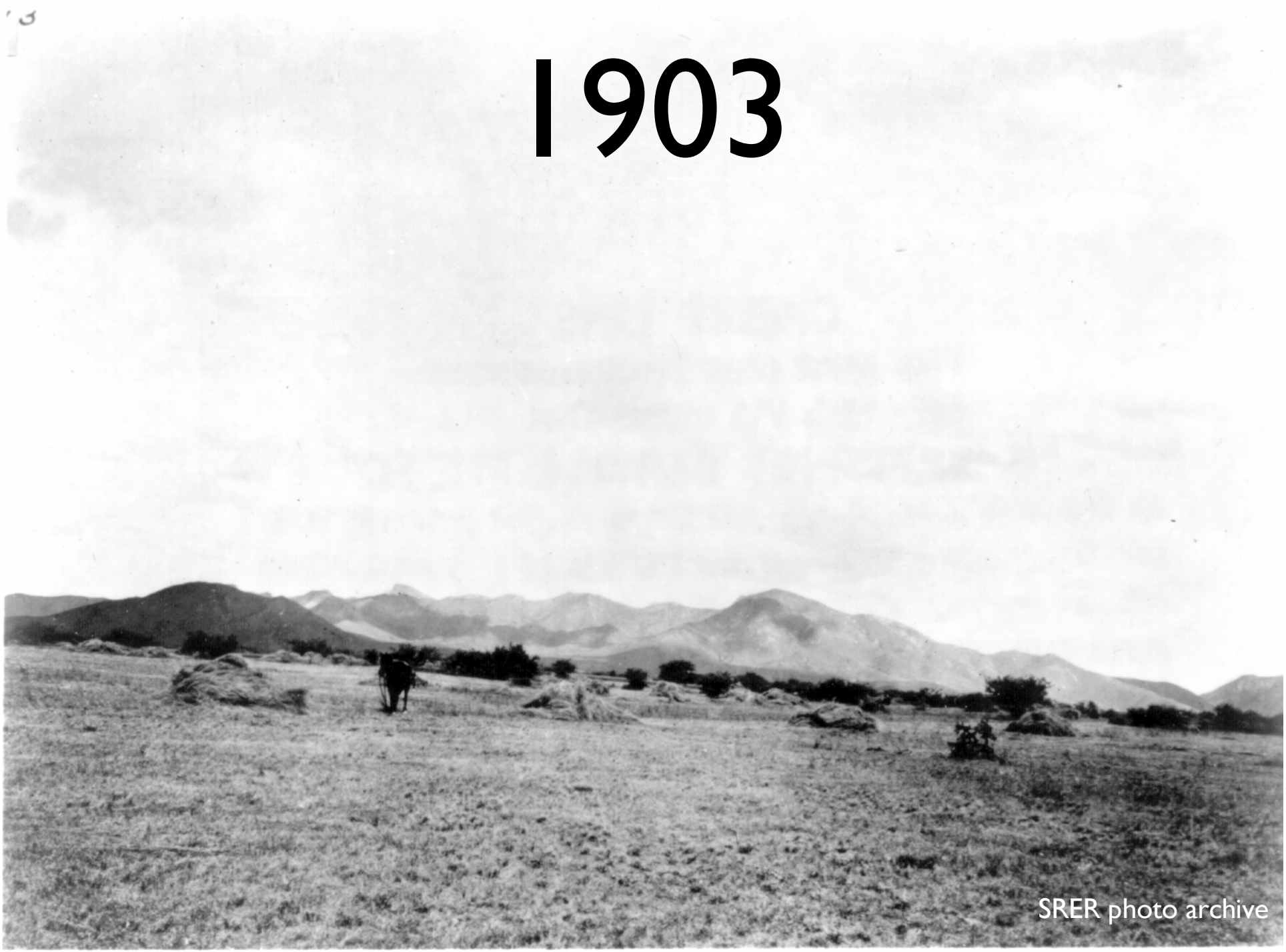
Taking the pulse of a mesquite savanna on the SRER

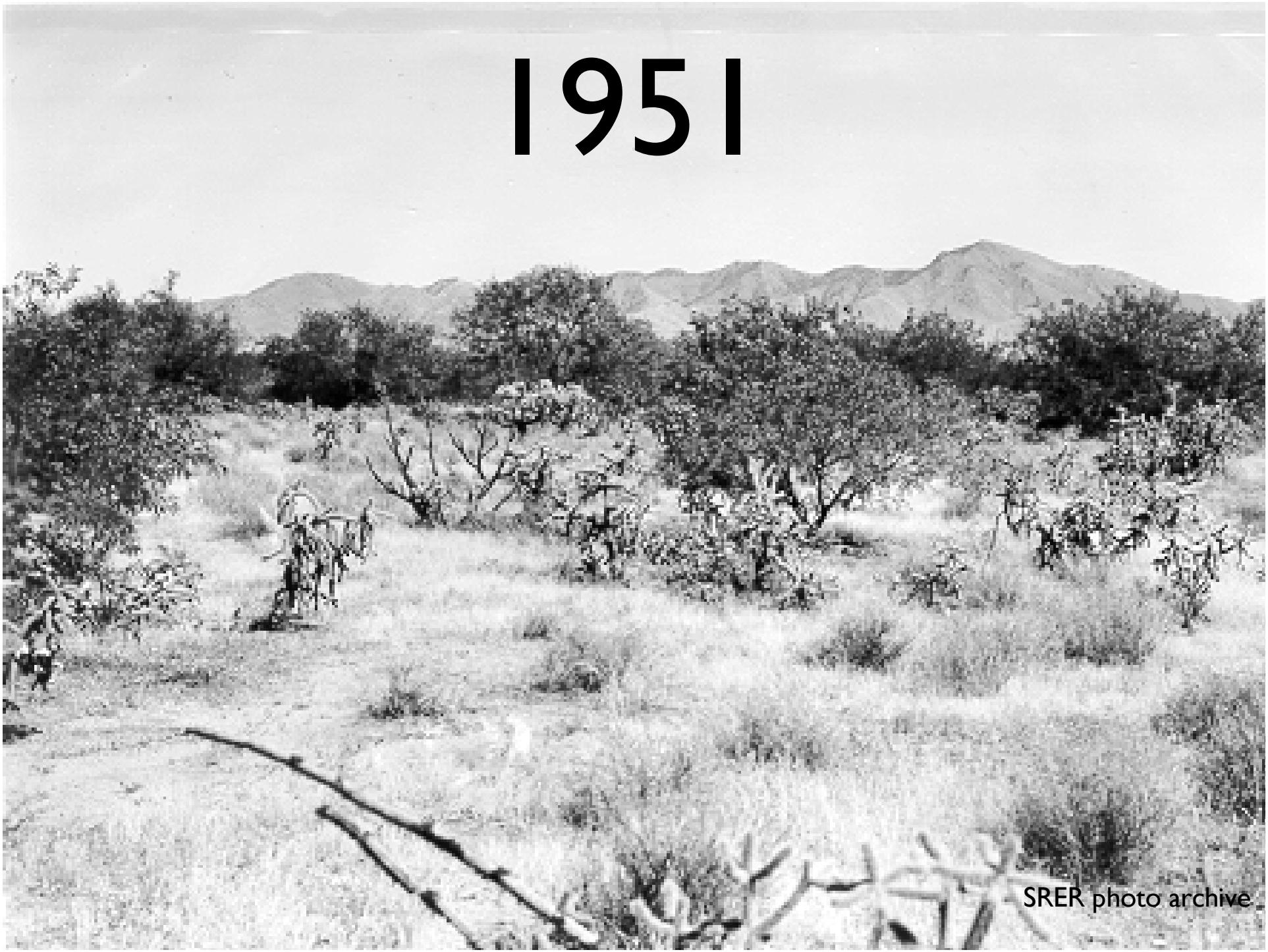
Russell Scott, USDA-ARS

Southwest Watershed Research Center
Tucson, Arizona

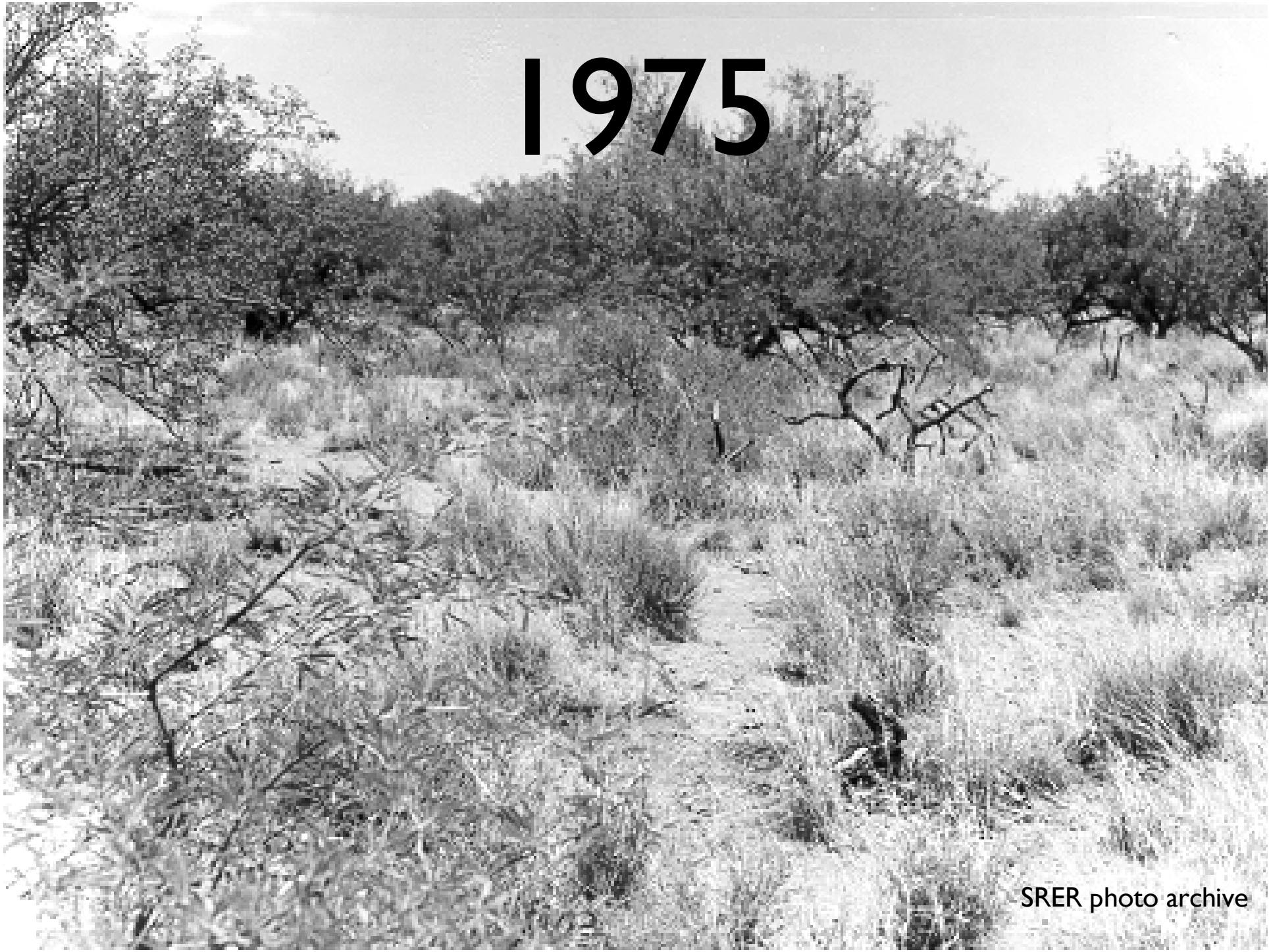
1903



1951



SRER photo archive

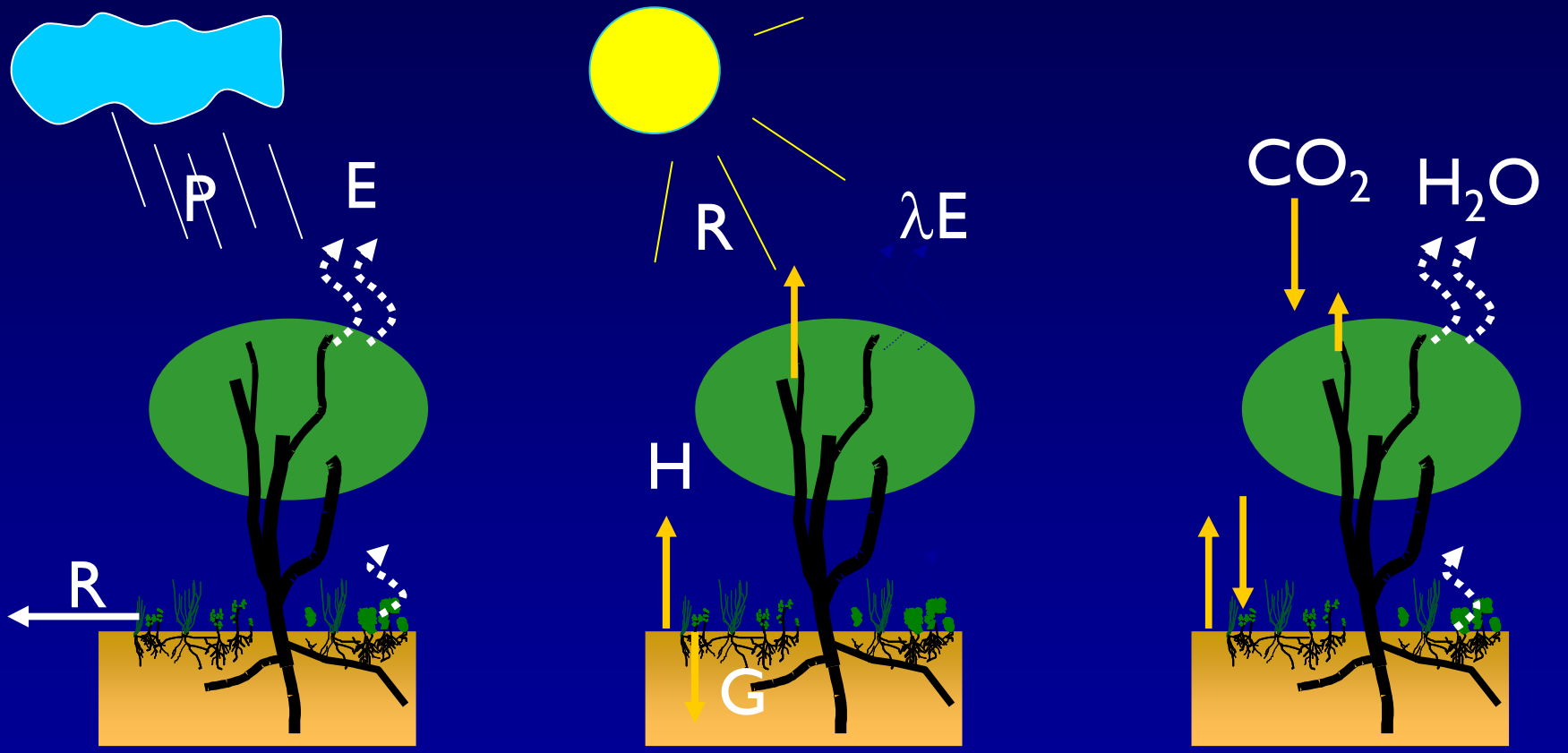

1975
SRER photo archive

What are the consequences of woody plant encroachment?

1. Rangeland productivity
2. Ecosystem services
3. Energy and mass exchange
4. Scaling from local to global biogeochemical cycles

Southwest Watershed Research Center
Tucson, Arizona

Taking the pulse of an ecosystem



Water **Energy** **Carbon dioxide**

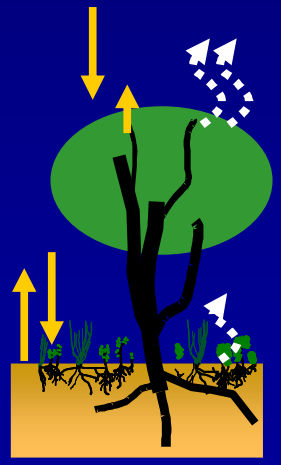
How does woody plant encroachment affect the "pulse" of an ecosystem?

Southwest Watershed Research Center
Tucson, Arizona

Current focus

Understand how interannual and intra-annual variations on precipitation affects CO_2 exchange in a mesquite-encroached grassland

1. Precipitation
2. Vegetation status
3. CO_2 exchange

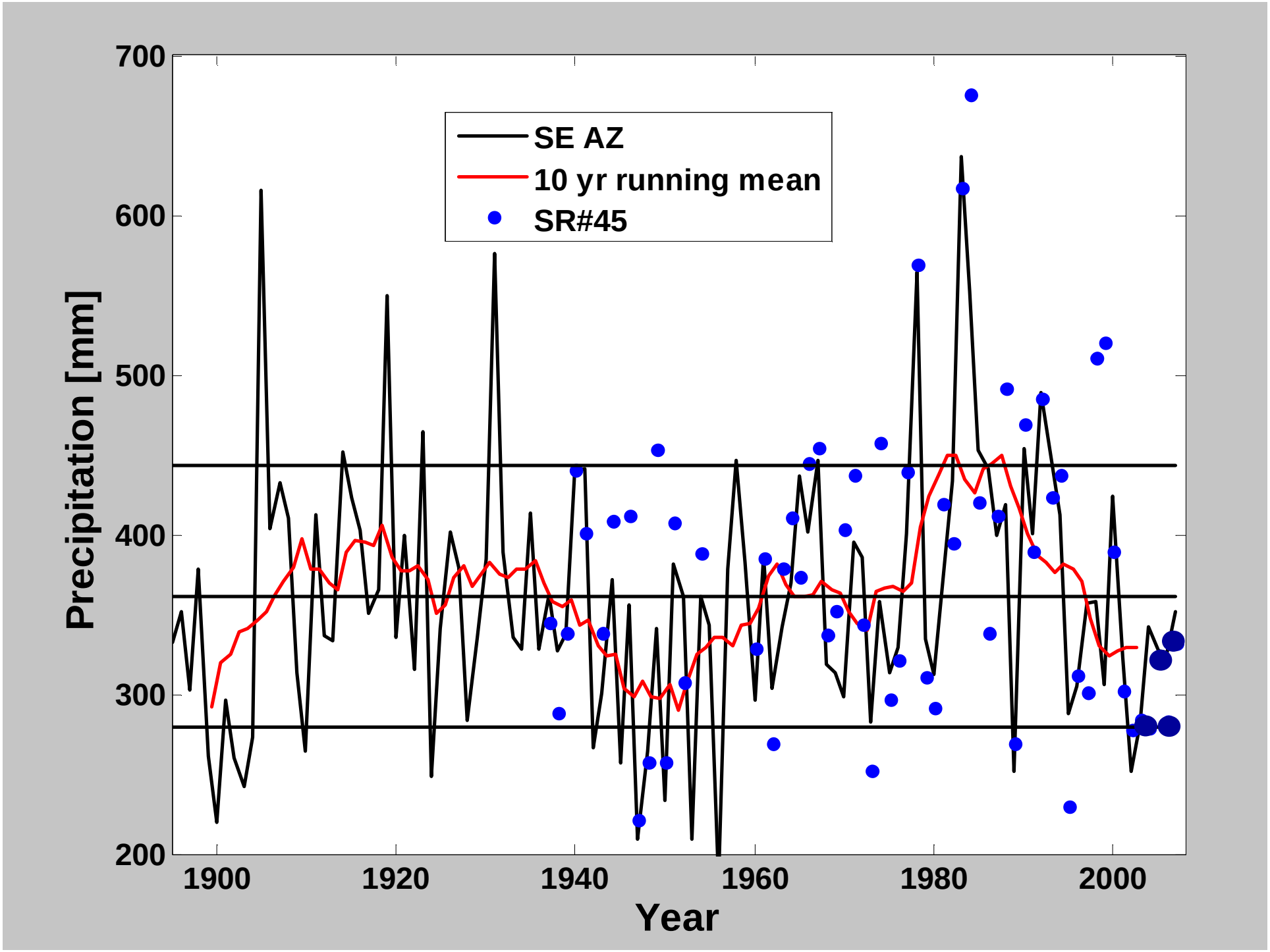


Southwest Watershed Research Center
Tucson, Arizona

Methodology

Precipitation

Southwest Watershed Research Center
Tucson, Arizona

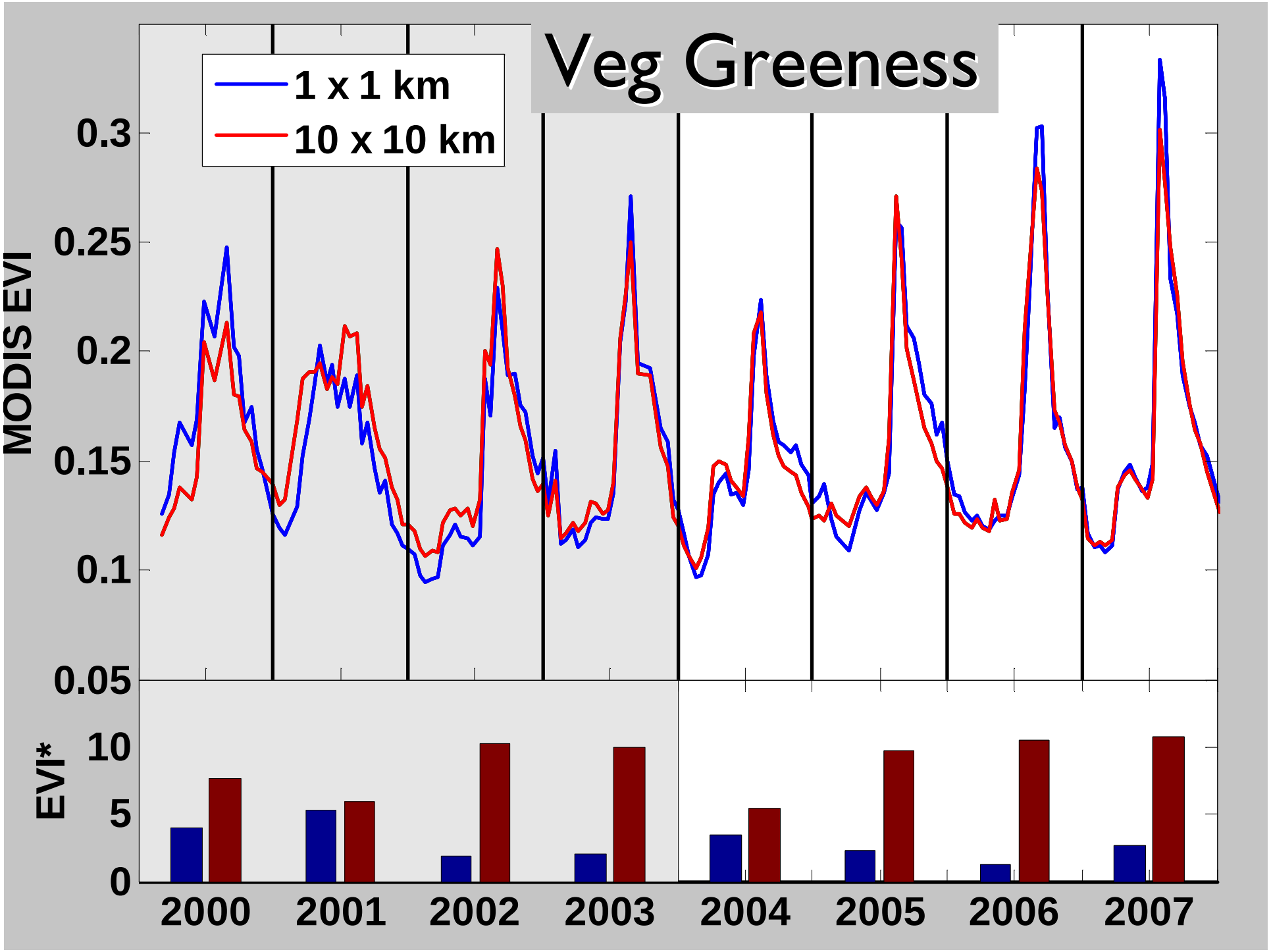

SE AZ
10 yr running mean
SR#45
Precipitation [mm]
Year
700
600
500
400
300
200
1900
1920
1940
1960
1980
2000

	2004	2005	2006	2007	1936-2006
Winter (Dec. - Mar.)	59	61	**35**	65	98 (57)
Monsoon (Jul. - Sep.)	**153**	243	229	221	203 (70)
Annual Precipitation	285	335	289	330	377 (92)

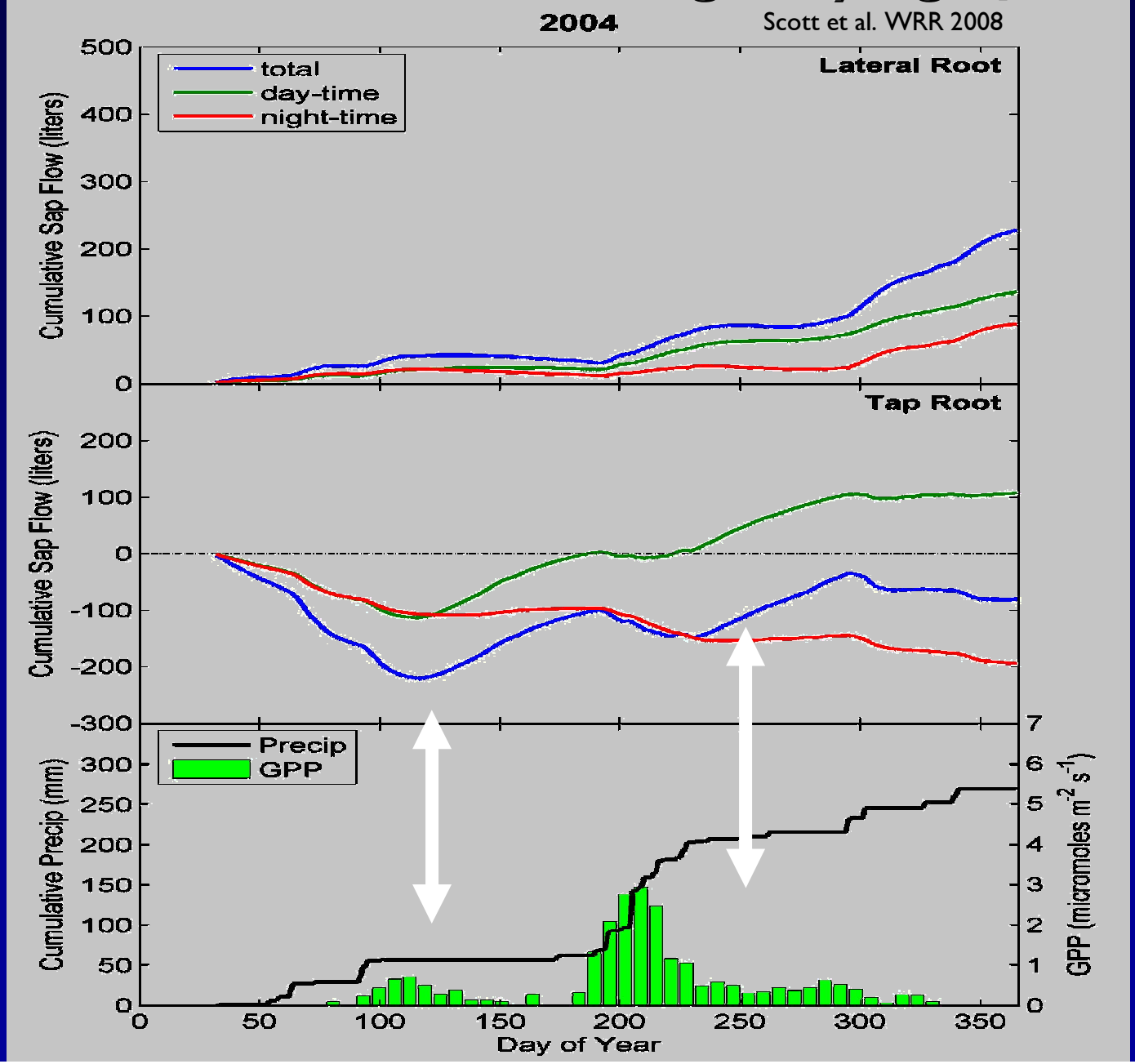
Southwest Watershed Research Center
Tucson, Arizona

Vegetation

Southwest Watershed Research Center
Tucson, Arizona

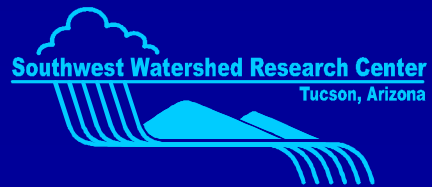

Veg Greeness
1 x 1 km
10 x 10 km
MODIS EVI
0.3
0.25
0.2
0.15
0.1
0.05
EVI*
10
5
0
2000
2001
2002
2003
2004
2005
2006
2007

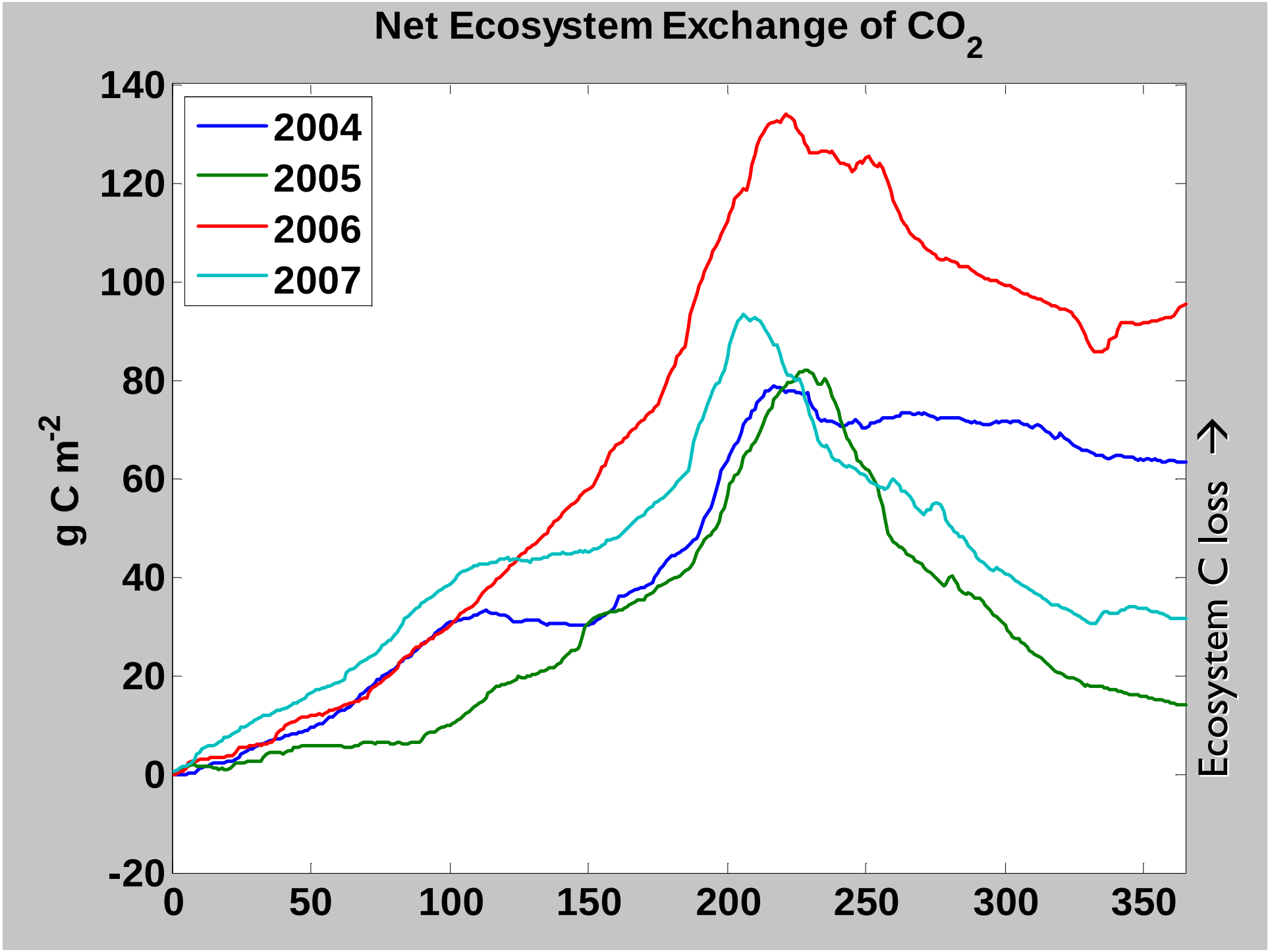
Is this redistribution ecologically significant?

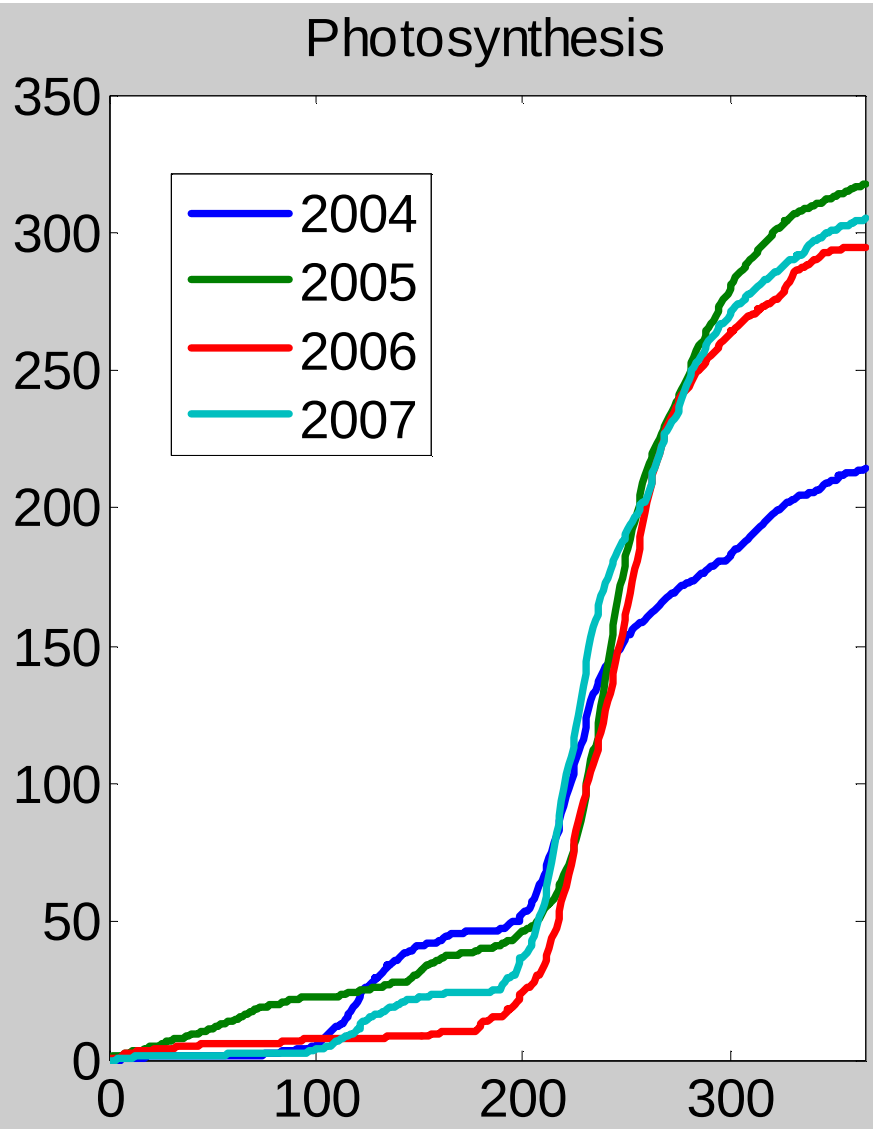


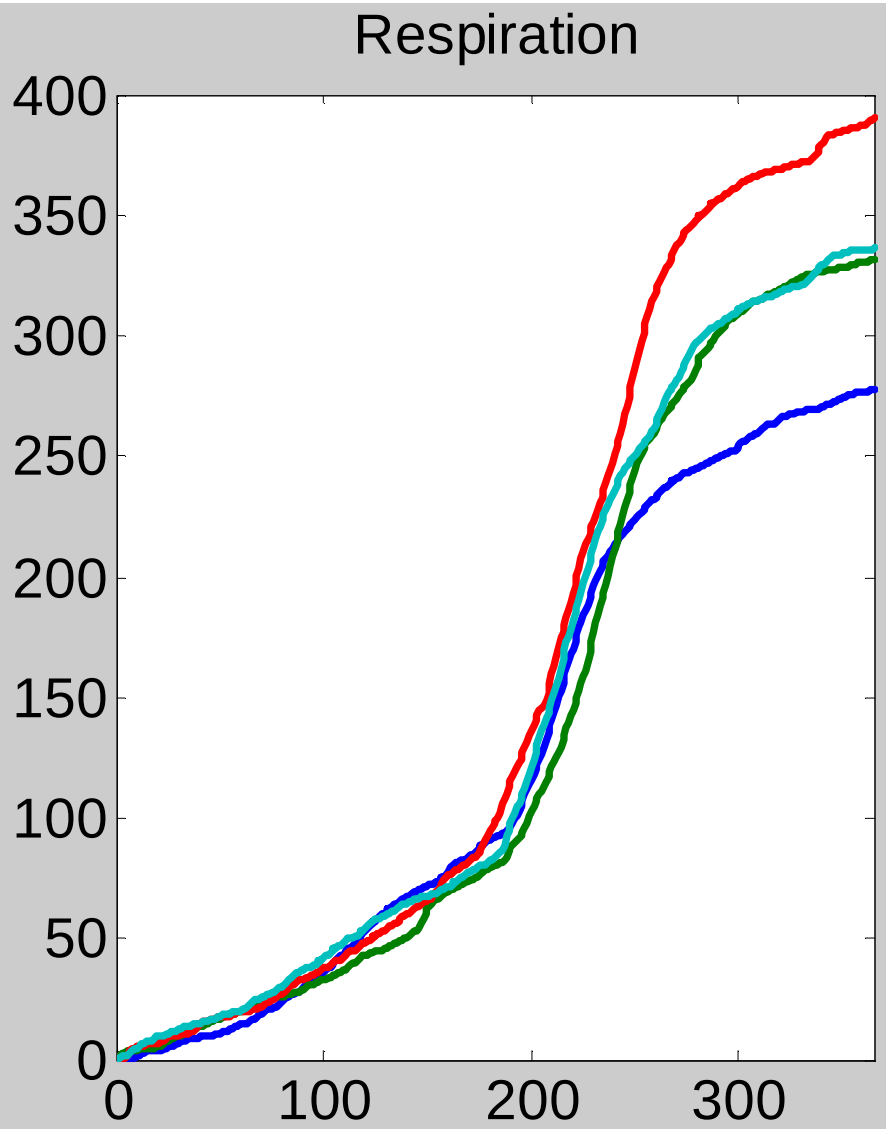
Spring and late summer growth supported by tap roots

NEE



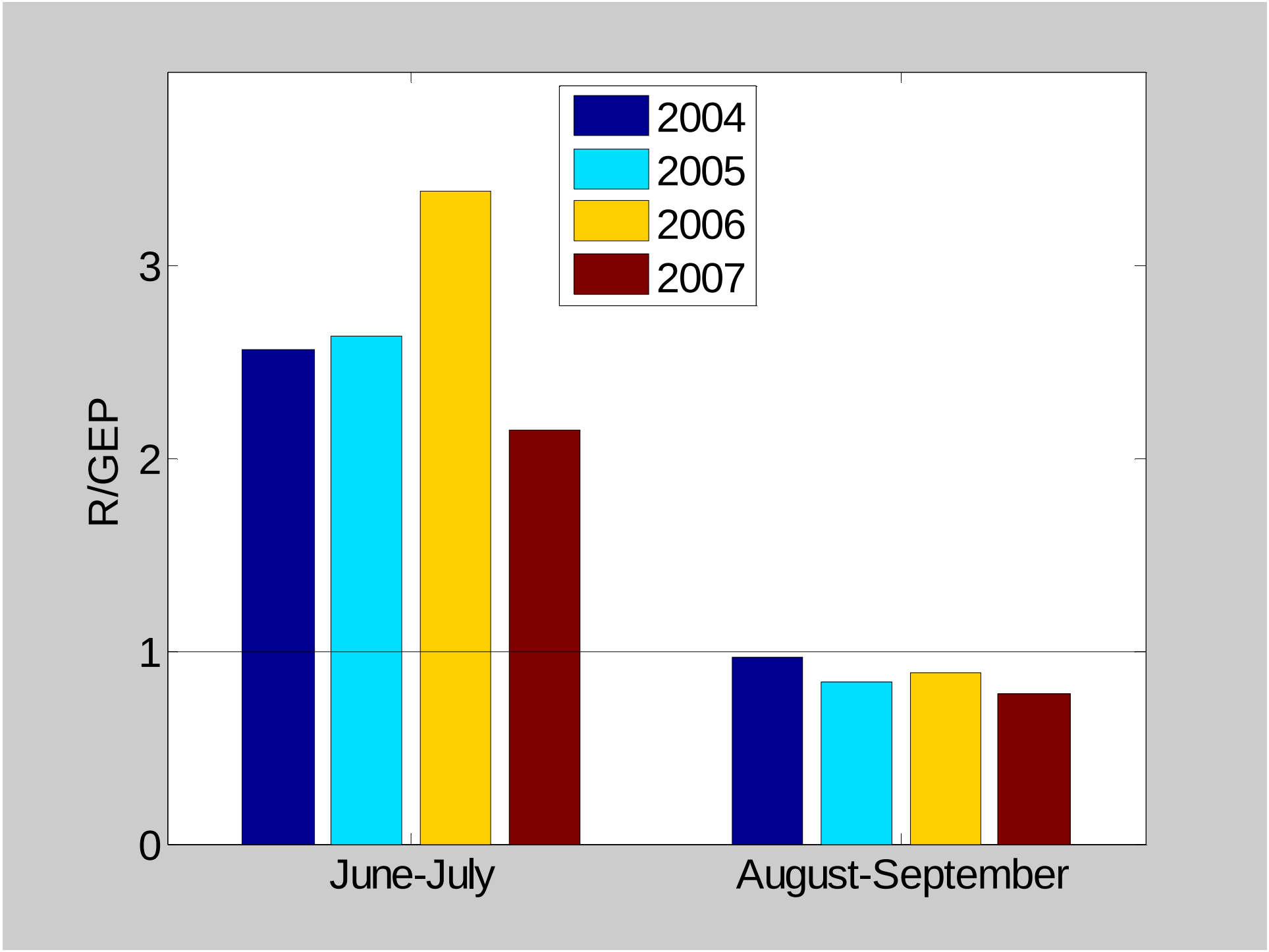

Net Ecosystem Exchange of CO_2
2004
2005
2006
2007
140
120
100
80
60
40
20
0
-20
0
50
100
150
200
250
300
350
g C m^{-2}
Ecosystem C loss →

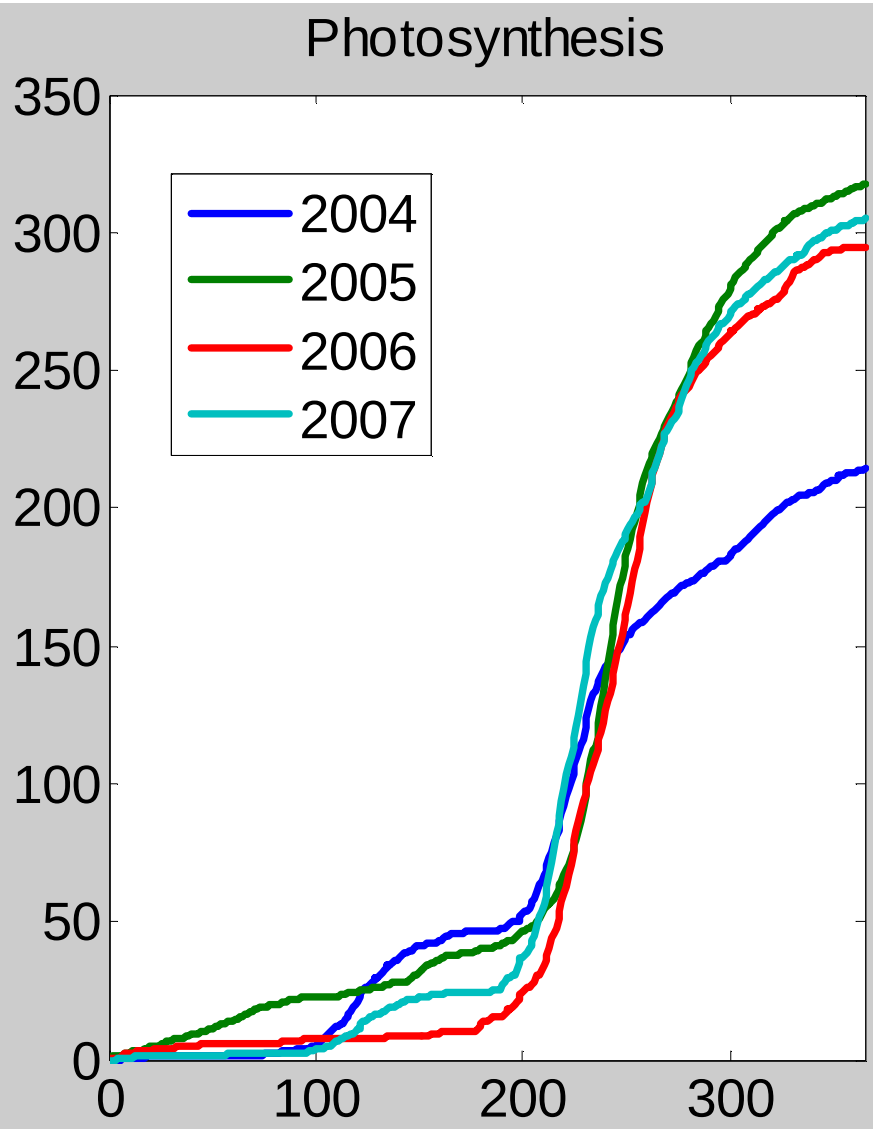


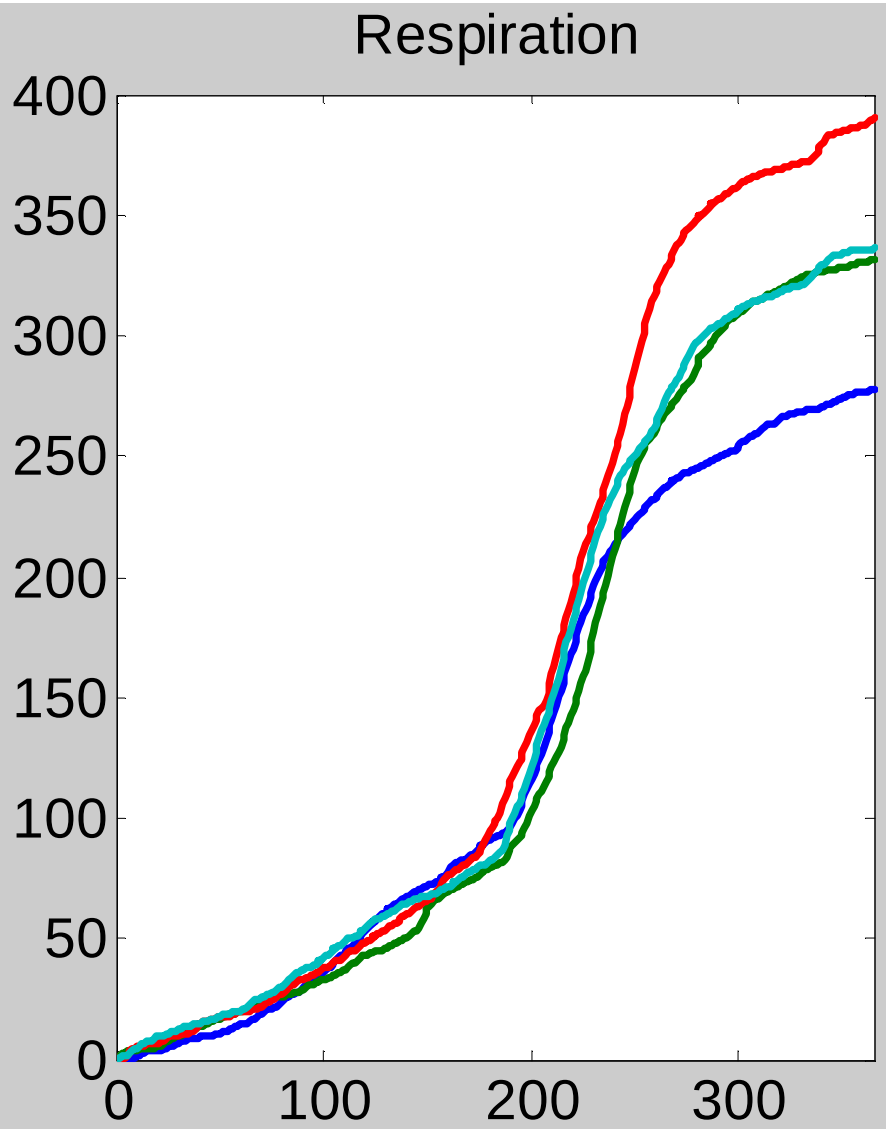


NEE =R - GEP

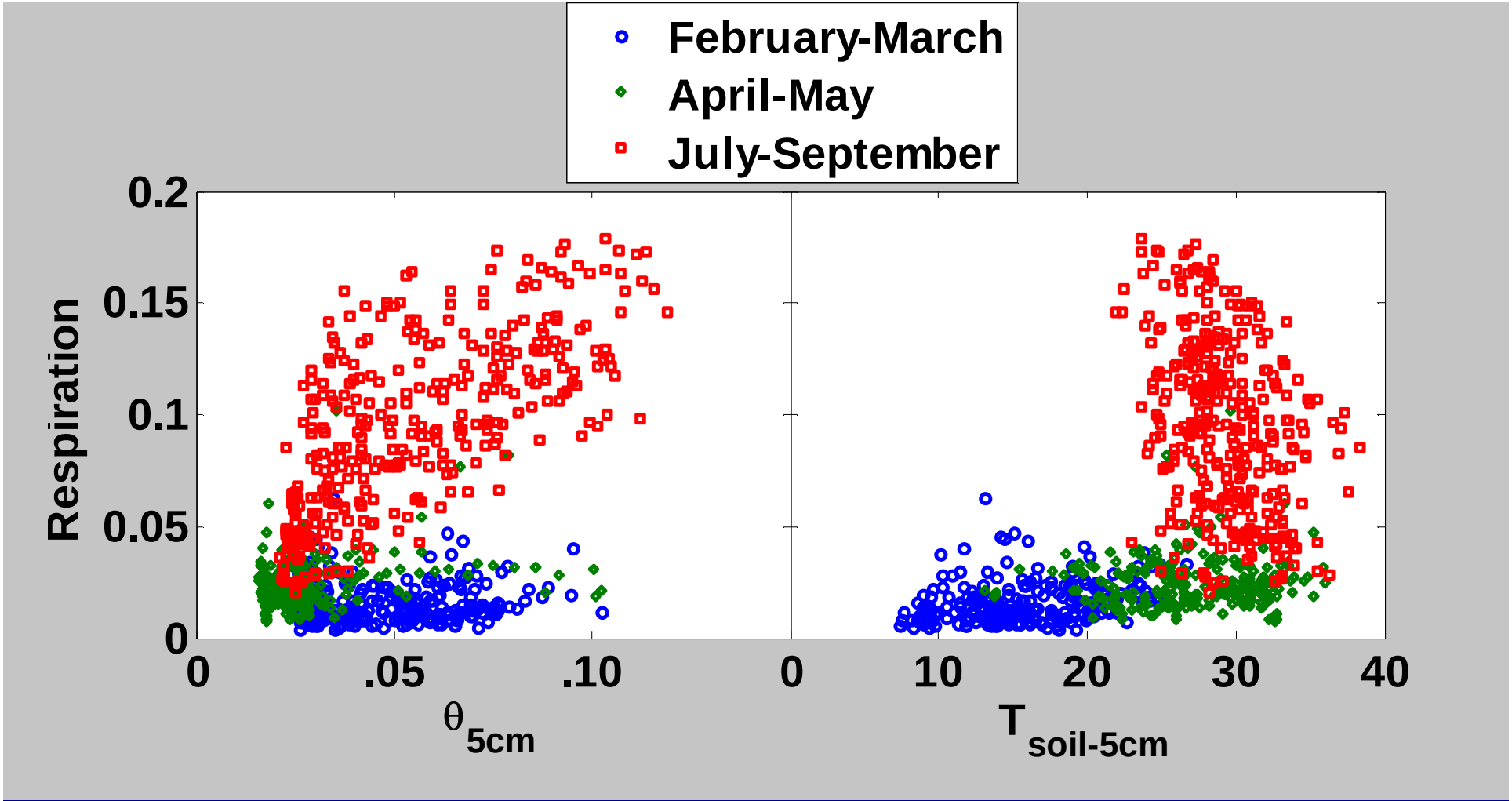
Southwest Watershed Research Center
Tucson, Arizona


2004
2005
2006
2007
R/GEP
0
1
2
3
June-July
August-September





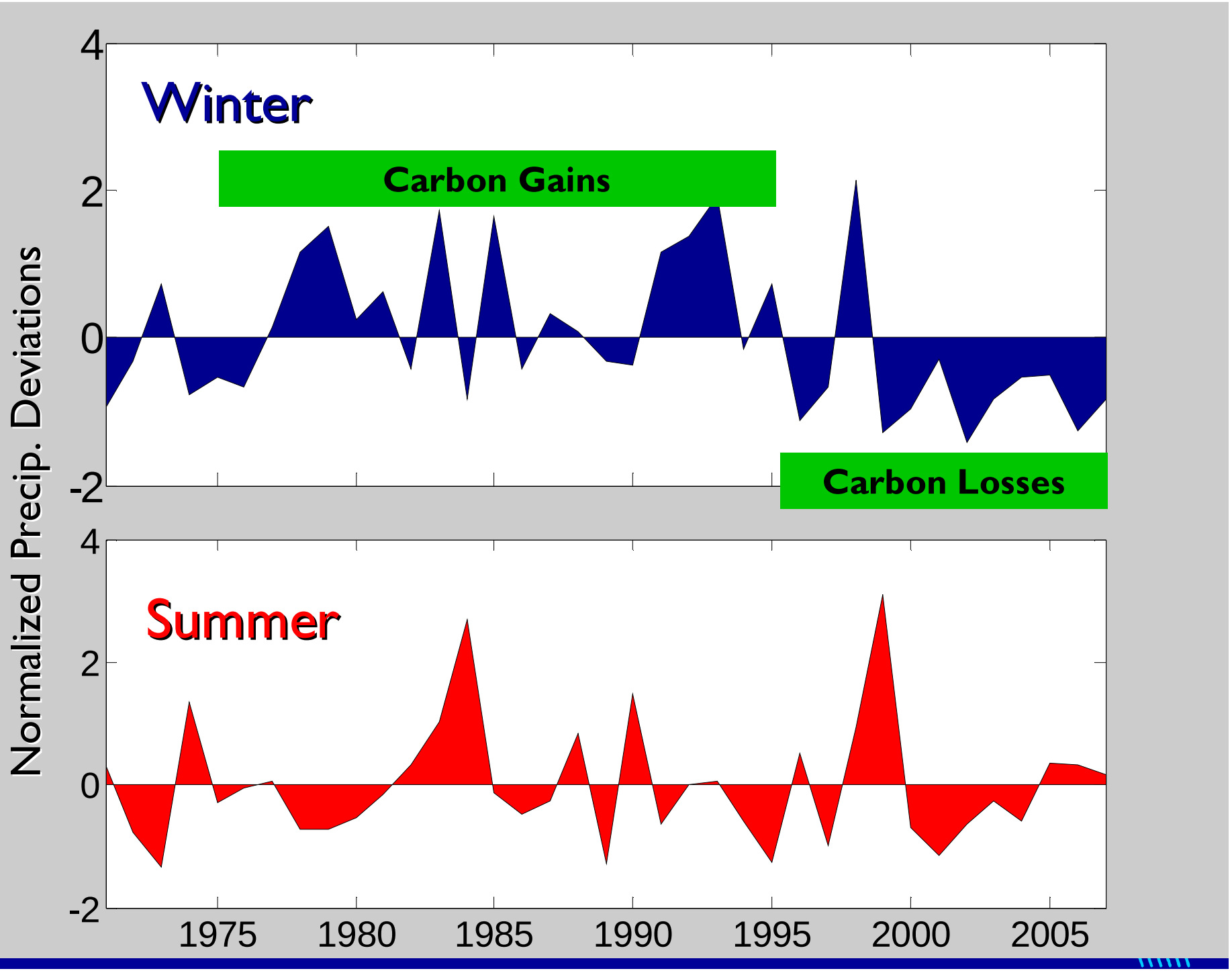
Southwest Watershed Research Center
Tucson, Arizona



Southwest Watershed Research Center
Tucson, Arizona

Where did we come from? Where are we headed?

Southwest Watershed Research Center
Tucson, Arizona


Winter
Carbon Gains
Carbon Losses
Summer
Normalized Precip. Deviations
4
2
0
-2
1975
1980
1985
1990
1995
2000
2005

Conclusions

- 2004-2007 may be a preview of things to come
- As annual drought severity ↑, NEE ↑
- Spring drought led to no changes in spring R and enhanced summer R
- Summer drought increased net CO_2 loss by decreasing amount of late season growth


“The desert is beautiful!
Yeah it is.”
P. Mesquitey